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Protective coating, in particular for a magnetic storage medium, and a method for its manufacture

The present invention relates to a protective coating, preferably for a magnetic storage medium, such as is used, for instance in electronic computers and data processing systems, and a method for the manufacture of this coating.

It is known that magnetic storage media can be provided with a protective coating to protect said coating against corrosion, impact and wear. Metal coatings, non-metallic coatings and also oxide coatings are used to provide protection. The methods of applying these coatings to the storage medium vary. A method of precipitation from the liquid or gaseous phase is known.

A disadvantage of the known protective coatings is that they are, in part, very susceptible to damage as a consequence of impact. Once a coating of this type is damaged, it is subject to further destruction until it ultimately wears away completely. Damage to the coating also results in damage to the storage medium, so that information becomes corrupted.

Furthermore, the technical effort required is very great and the production costs are high.

The purpose of the present invention is to protect a magnetic storage medium against mechanical stress, such as friction and impact, while minimising the technical effort involved.

The object of the invention is to provide a magnetic storage medium with a firmly adhering and elastic protective coating on both sides in a single operation.

The object is solved according to the invention by using as the protective coating a polymer coating, the raw material of which consists of one or more organic substances. This coating has different or identical characteristics at points at different distances from its base surface. The areas of the coating that are in contact with the magnetic storage medium or are in the immediate vicinity of it, have a high bond strength with the substrate while the upper surface of the polymer coating has a high elasticity. These characteristics can change from the base surface of the coating through to its upper surface by reason of its internal composition and/or degree of polymerisation. The coating is very resistant to impact and abrasion by reason of its having high elasticity at its upper surface.

The protective coating is precipitated out of the plasma of one or more organic substances (monomers). In this way, a polymer coating is grown on the storage medium located within the effective area of the plasmas. The plasma is triggered and maintained by means of a direct voltage, a technical alternating voltage, a high frequency voltage, a pulse discharge, or as a direct voltage discharge supported by a magnetic field or as a hot cathode glow discharge. It is advantageous to keep the magnetic storage medium to be coated in motion during the precipitation and polymerisation processes. This enhances the homogeneity of the protective coating. The presence of an inert or reactive gas also has a favourable effect.

The composition and the degree of polymerisation of the precipitated polymer coating and thus its properties are changed by modifying the process parameters such as pressure, current, voltage, monomer throughput speed, mixing ratio of the various monomers or of a monomer and an inert gas and the temperature of the storage medium during the precipitation and polymerisation processes. Consequently, the coating is given different properties at points at different distances from the base surface.

The protective coating according to the invention has a series of valuable characteristics: homogeneity, good adhesion to the substrate, good elasticity, corrosion resistance, thermal resistance and freedom from pores. The magnetic storage medium is protected by this coating against the occurrence of mechanical stresses, such as friction and impact, and chemical aggression.

The manufacture and application of the protective coating on the storage medium are very simple. The manufacturing costs are low and the method is suitable for series production.

The invention will be explained in more detail below by two examples.

Example 1:

Twenty magnetic discs with a diameter of 320 mm are arranged immediately after the application of their magnetic coating in an insulating rack in a cascade at a distance of 3 cm from one another. Two auxiliary discs (electrodes) are included in the stack of discs at either end of the stack. The

discs are connected together in such a way that all the odd-numbered discs are connected to the one pole, and the even-numbered ones to the other pole. The temperature of the discs is 25 °C. The cascade of discs is placed in a vacuum chamber, whose total pressure is reduced to ≤ 1x 10^{-4} Torr. A constant pressure of 5 Torr is maintained by restricting the performance of the vacuum pump and simultaneously letting in argon. The discharge is triggered by means of 50 kHz alternating voltage. A current density of 10 mA/cm^2, regulated through the voltage, is required for the glow cleaning process before deposition, which lasts for three minutes. After the cleaning process, the current density is reduced to 1 mA/cm^2. At the same time, a partial pressure of hexamethyldisiloxane of 1X10^{-3} Torr is set up and maintained over a period of 5 minutes. The partial pressure of the siloxane is then continuously increased over a period of 5 minutes while the discharge current density is kept the same in order to reduce the degree of polymerisation. The result of this process is a coating with a thickness of 1 µm with the desired characteristics, in particular the bond strength with the substrate and elasticity on the upper surface. The precipitation process is ended by switching off the current with the presence of monomer substances, which keeps the degree of polymerisation low, particularly on the upper surface of the coating. The stack of discs is tempered for 120 minutes at 150 °C to remove the free compounds present in the freshly formed coating and to stabilise the characteristics achieved.

The result of the selective control of the degree of polymerisation in the coating and thereby of the variable characteristics such as bond strength, hardness and elasticity is that external mechanical effects such as friction and impact stresses are absorbed and trapped by the polymer coating so that the coating to be protected is not damaged.

Example 2:

A magnetic storage medium material in tape form passes through two vacuum chambers connected one after the other through a pressure reducing stage. The first chamber has an argon atmosphere at 3 Torr and the second chamber an octamethyltrisiloxane atmosphere at 0.5 Torr. A flat electrode, 300 mm long and projecting 50 mm to either side of the tape is mounted above and below the tape to be coated. The two electrodes are spaced at 40 mm from the substrate material tape. The tape is initially pre-cleaned in a plasma generated by a 1.5 KV alternating voltage at a frequency of 50 Hz. In the second chamber, in which the coating is actually applied, two electrode systems of differing lengths are arranged. The distance from the electrodes to the tape and their width are the same as for the electrodes in the cleaning chamber. The first electrode system is 100 mm long. A plasma is generated here by an 800V alternating voltage with a frequency of 50 kHz. The voltage at the second electrode system, which is 300 mm in length, is 350V, also at a frequency of 50 kHz. The tape runs at a speed of 15 cm/min and is coated with an impact and shock resistant 1 µm thick protective coating once it has passed through the electrodes.

Patent claims:

1. Protective coating, preferably for a magnetic storage medium, characterised in that it is formed from a polymer coating, the raw material of which consists of an organic substance or a plurality of organic substances and that it has the same or different characteristics at spots at different distances from its base surface.

2. Method for the manufacture of a protective coating preferably for a magnetic storage medium, characterised in that it is precipitated from the plasma of one or more monomers or from the plasma of a mix of monomers and an inert or reactive gas and polymerised and applied directly to the storage medium, with the external process parameters such as pressure, temperature, current, voltage and throughput of the monomers being varied during precipitation and polymerisation in order to achieve differing characteristics at points in the coating at different distances from the base surface.

3. Method according to claim 2, characterised in that the magnetic storage medium to be coated is kept in motion during the precipitation and polymerisation process.

4. Method according to claim 2 or 2 and 3, characterised in that the discs are arranged in a cascade and are connected electrically in series or alternately in parallel.

5. Method according to claim 2, characterised in that the discs are tempered after processing.